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*Bensley, S.E.; Aazhang, B.;*

Communications, IEEE Transactions on , Volume: 46 , Issue: 3 , March 1998

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*Wei-Chiang Wu; Kwang-Cheng Chen;*

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## Maximum-likelihood synchronization of a single user for code-division multiple-access communication systems

[Bensley, S.E.](#) [Aazhang, B.](#)

Cabletron Syst., Rochester, NH, USA ;

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**Abstract:**

Code-division multiple access (CDMA) has emerged as an access protocol well-suited for voice and data transmission. One significant limitation of the conventional CDMA system is the near-far problem where strong signals interfere with the detection of a weak signal. Multiuser detectors assume knowledge of all of the modulation waveforms and channel parameters, and exploit this information to eliminate multiple-access interference (MAI) and to achieve near-far resistance. A major problem in practical application of multiuser detection is the estimation of the signal and channel parameters in a near-far limited system. We consider maximum-likelihood estimation of users delay, amplitude, and phase in a CDMA communication system. We present an approach for decomposing this multiuser estimation problem into a series of single-user problems. In this method the interfering users are treated as colored non-Gaussian noise. The **observation vectors** are preprocessed to be able to apply a Gaussian model for the MAI. The maximum-likelihood estimate (MLE) of each user's parameters based on the processed **observation vectors** becomes tractable. The estimator includes a whitening filter derived from the sample covariance matrix which is used to suppress the MAI, thus yielding a near-far resistant estimator

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